Citation:

Radhika G, Sudha V, Mohan Sathya R, Ganesan A, Mohan V. Association of fruit and vegetable intake with cardiovascular risk factors in urban south Indians. *Br J Nutr.* 2008 Feb;99(2):398-405. Epub 2007 Aug 3.

PubMed ID: 17678569

Study Design:

Population-based, Cross-sectional Study

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To evaluate the association of fruit and vegetable intake with cardiovascular risk factors such as obesity, hypertension, fasting plasma glucose and dyslipidemia in urban Asian Indians in southern India.

Inclusion Criteria:

Subjects were recruited from the Chennai Urban Rural Epidemiology (CURES) Study.

Exclusion Criteria:

Subjects with self-reported history of diabetes or hypertension or CVD, or on drug therapy for dyslipidemia were excluded (n = 160).

Description of Study Protocol:

Recruitment

- CURES is an ongoing epidemiological study conducted on a representative population of Chennai (population of 5 million).
- A systematic method of sampling was used to screen and include the subjects.
- This was followed by a probabilistic proportion technique.
- Finally, every tenth subject was recruited and invited to participate in the research protocol.

Design - Population-based, Cross-sectional Study

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Statistical Analysis

- Means and standard deviations for the general and clinical characteristics.
- One-way ANOVA or Student's t-test as appropriate for continuous variables.
- Chi-square for comparison of proportions.

Data Collection Summary:

Timing of Measurements

One time measurement.

Dependent Variables

- Cardiovascular risk factors such as blood pressure, BMI, waist circumference, blood glucose, serum cholesterol, triglyceride level, LDL and HDL cholesterol measured using standard laboratory methods

Independent Variables

- Fruit and vegetable intake measured using a validated semiquantitative food frequency questionnaire

Control Variables

- Age
- Sex
- Smoking
- Alcohol
- BMI
- Total energy intake

Description of Actual Data Sample:

Initial N: 1143 out of 1300 individuals agreed to participate.

Attrition (final N): Final sample of 983 adults (87.9% response rate), after application of exclusion criteria.

Age: mean age of women = 38.8 ± 11.5 years, mean age of men = 40.2 ± 12.6 years

Ethnicity: Indian

Other relevant demographics: Most of the subjects were non-vegetarians; about 25% of the subjects were vegetarians.

Anthropometrics:

Location: Chennai, India

Summary of Results:

Key Findings:

- After adjusting for potential confounders, the highest quartile of fruit and vegetable intake (g/day) showed a significant inverse association with systolic blood pressure (β = -2.6 mmHg, 95% confidence interval: -5.92 to -1.02, P = 0.027), BMI (β = -2.3 kg/m^2, 95% confidence interval: -2.96 to -1.57, P < 0.0001), waist circumference (β = -2.6 cm, 95% confidence interval: -3.69 to -1.46, P < 0.0001), total cholesterol (β = -50 mg/L, 95% confidence interval: -113.9 to -13.6, P = 0.017) and LDL-cholesterol (β = -55 mg/L, 95% confidence interval: -110.8 to -11.1, P = 0.039) when compared with the lowest quartile.

Other Findings

- The highest quartile of fruit and vegetable intake explained 48% of the protective effect against CVD risk factors compared with the lowest quartile of intake.

Author Conclusion:

Increased intake of fruits and vegetables could play a protective role against CVD in Asian Indians who have high rates of premature coronary artery disease.

Reviewer Comments:

Large representative population. Authors note that physical activity was not controlled in the present study, but could have, at least in part, been adjusted by adjusting for BMI and total energy intake.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes

1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	N/A
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes

4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes

7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes